



Research Article

Estimation of selected inorganic salt contents present in the ground water of industrial zone of Visakhapatnam

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Abstract: The city of destiny, Visakhapatnam is surrounded by beautiful Bay of Bengal on one side and about 72 large scale industries undertaken by public sector on other side. The city was glorified with its land marks viz Visakhapatnam steel plant, ESSAR Steel, BHPV, Hindustan shipyard, Rastiya Ispat Nigam Limited, NTPC Power Project, Simhadri Thermal Power Project, National Mineral Development, Ferro Scrap Nigam Ltd. The steel city is prone to effected by large number of industrial effluents though huge investments were allocated on the treatment plants, people are frequently experiences the problems with ground water. In this scenario we would like to present the total fluorides, chloride, nitrates and phosphates were estimated by random collection of ground water samples. In order to estimate leachates of the ground water the titrimetric methods were adopted.

INTRODUCTION

The study deals with physico-chemical characteristics of groundwater in the environs of Greater Visakhapatnam

Municipal Corporation (GVMC), Visakhapatnam district, Andhra Pradesh. The study area covering about 500 kms where major industries are located thus it is often called as Visakha Steel City. The city covered by the hills of Kailasagiri and Yarada with altitude ranges from 507 and 357 meters respectively and the eastern side is surrounded by the Bay of Bengal. The area experiences semi-arid climate, with temperature in the range of 14-38⁰C. The area has been covered with deciduous forest around 33.33 kms, declining rapidly due to urbanization and industrialization (Byragi Reddy et. al. 2013). The study area is inhabited with around million populations besides major and other ancillary industries. As per 2011 census, the decennial growth rate of population in the area is around 22.44%. The high density of population is about 1,280,670 in Visakha urban areas whereas less density in rural areas. Solid waste generating from the urban environment is polluting water, soil and air besides unhygienic surroundings SubbaRao and Krishna Rao (1990).

Investigations in study area revealed that, rapid growth in population during the recent decades resulted in increasing quantity of urban solid wastes. Municipal solid waste consists of day-to-day consumed and discarded items such as food wastes, hospital bio waste, product packaging, and other miscellaneous like residential, commercial, institutional and industrial sources. There are no major surface water bodies in the area and the dependable groundwater resources are being polluted after the incidence at an alarming rate (Vdela et. al.1997).

Most of the industries have their own mechanism for handling industrial solid waste. Chemical residues discharged into the sewerage system may have adverse effects on the operation of biological sewage treatment plants or toxic effects on the natural ecosystems of receiving waters (Figure). Similar problems may be caused by pharmaceutical residues which may include antibiotics and other drugs, heavy metals such as mercury, phenols and their derivatives and many disinfectants and antiseptics. These substances are commonly present in small quantities in health-care waste, larger quantities may be found when unwanted or outdated chemicals and pharmaceuticals are disposed off. They may cause intoxication, either by acute or by chronic exposure, and injuries, including burns.

An extensive amount of chloride is added to ground water receiving municipal waste, farm drainage and sewage effluent. The sewage effluent to water sources is bound to increase the chloride concentration in ground water. Chlorides are naturally present in water in the form of sodium chloride. These contribute a salty taste to water. The taste may be objectionable to several consumers. Chlorides coupled with

sodium bring to bear salty taste, when its concentration is more than 250 mg/L.

METHODOLOGY

In this study, about 25 water samples were collected to analyze chemical parameters in laboratory). The samples were analyzed for determining the concentrations of various chemical elements such Cl^- , F^- , NO_3^- , PO_4^{3-} , Samples were analyzed in laboratory for the NO_3^- , PO_4^{3-} were analyzed using UV Visible Spectrophotometer method (Shimadzu, Japan). pH of all the samples were recorded on pH meter (Equip-Tronic).

Determination of chloride present in ground water: About 25 ground water samples were collected from north, east, west, southern parts of Visakhapatnam and the estimation was carried out titrimetrically. 20 ml of each ground water sample is pipetted out in a clean conical flask and a drop K_2CrO_4 solution is added. It is titrated with 0.01 M AgNO_3 until a permanent faint red color is observed. Chloride concentration in excess of about 250 mg/L can give rise to detectable taste in water, but the threshold depends upon the associated cations. Consumers can however, become accustomed to concentrations in excess of 250 mg/L.

Determination of Fluoride present in ground water: Fluoride plays a vital role in water quality management due to adverse health effects. A fluoride concentration up to 1.0mg/L in drinking water effectively dental caries without harmful effects on health. In rare instances the naturally occurring fluoride concentration may approach 10 mg/L; in such cases water should be defluoridated.

Among the methods suggested for determining fluoride ion in water, the electrode and colorimetric methods are the most satisfactory. In the present investigation we have adopted SPANDS

colorimetric method, which is based on the principle that the reaction between fluoride and Zirconyl-dye lake, fluoride reacts with the dye-lake, dissociating portion apportion of into in to a colorless complex anion $[(ZrF_6)^-]^{-2}$, and the dye. As the fluoride content increases, the color produced progressively disappears.

Procedure: To prepare fluoride standards in the range of 0 to 1.40 mg per L by diluting appropriate quantities of standard fluoride solution to 50 ml. with distilled water. In to a large testing tube Pipette out 5.00 ml. each of SPADNS solution and Zirconyl acid reagent to each standard and mixed well. Care must be taken to avoid contamination. Photometer was set to zero absorbance with the reference solution and absorbance of the standard solutions was recorded.

Preparation of SPADNS solution: 958mg SPADN is dissolved along with sodium 2-(p-sulpho phenyl azo 1,8 dihydroxy-3,6naphthalene disulphonate, also called 4,5 dihydroxy -3-(para sulpho phenyl azo)- 2,7-naphthalene disulfonic acid trisodium salt, in distilled water and dilute to 500mL. The solution is stored in amber colored bottle and can be preserved for long period. A fluoride concentration of approximately 1.0 mg/L in drinking water effectively reduces dental caries without harmful effects on health. In rare instances the naturally occurring fluoride concentration may approach 10mg/L; such waters should be defluorinated.

Determination of phosphate: Molybdophosphoric acid is formed and reduced by stannous chloride to intensely colored molybdenum blue. This method is more sensitive and makes feasible measurements down 7 µg P/L by use of increase light length

Preliminary sample treatment: To 100ml samples containing not more than 200µg P and free from color and turbidity, add

0.05ml [1 drops] phenolphthalein Indicator. The sample is treated with strong acid in drop wise to discharge the pink color. Further with through mixing after each addition, 4.0ml molybdate reagent I and 0.5ml [10 drops] stannous chloride reagent I. Rate of color development and intensity of color depend on temperature of the final solution, each 1 degree increase producing about 1percent increase in color. The samples were standardized and reagent 2⁰C of one another and the temperature is maintained at 20 and 30⁰ C.

Color_measurement: After 10min or before 12min, using the same specific Interval for all determinations, color was measured photometric ally at 6900nm & compared with a calibration curve drawn with milligram fluoride-absorbance relationship.

Determination of Nitrate: For the determination of nitrite a simple and rapid method has been proposed using Sulfanilic acid. Determination of nitrate is based on the reduction of nitrate to nitrite in the presence of Zn/NaCl. The produced nitrite is subsequently diazotized with sulfanilic acid and then coupled with methylantranilate to form an azo dye and was measured at 493 nm. The developed method has been successfully applied to the determination of nitrate in different samples.

DISCUSSION

Chloride levels in unpolluted waters are often below 10 mg/litre and sometimes below 1 mg/litre (EURO Reports and Studies 2, 1978). Chloride in water may be considerably increased by treatment processes in which chlorine or chloride is used. If Chloride content increases the electrical conductivity of water and thus increases its corrosivity (Morales,1987). In metal pipes chloride reacts with metal ions to form soluble salts (EURO Reports and Studies 2, 1978; Gelb and Anderson,1981)

thus increasing levels of metals in drinking-water. In lead pipes, a protective oxide layer is built up, but chloride enhances galvanic corrosion (Phelan, 1987). It can also increase the rate of pitting corrosion of metal pipes (EURO Reports and Studies 2, 1978).

Conclusions: Chloride concentrations in excess of about 250 mg/L can give rise to detectable taste in water and the threshold depends upon the associated cations. Consumers can however, become

accustomed to concentrations in excess of 250 mg/L. No health-based guideline value is proposed for chloride in drinking-water. The chloride content was found to be abnormally high. Sample no. 11 and 12 were on similar lines showing higher levels nitrate and phosphates. The attempts were to create awareness in the public taking required control measures while using the ground water. Efforts are to be implemented by government and other social agencies in maintaining proper disposals for the cleaner environment and healthy society.

Table: 1. Chemical parameters of the study area in mg/L

S.NO.	Area in Visakhapatnam in and around	p ^H	Chlorides In mg/L	Fluoride in mg/L	Nitrates mg/L	Phosphate-mg/L
1.	Seethammadhara	6.60	180	0.67	1.67	1.58
2.	Sagarnagar	6.64	397	0.83	2.35	1.88
3	Gajuwaka	6.87	225	0.82	3.89	1.66
4	Visalakshinagar	6.69	162	0.84	2.10	1.43
5.	Kailashgiri	6.57	401	0.94	2.00	0.98
6	Kancharapalem	6.59	021	0.41	1.98	1.01
7.	Newcolony	6.42	225	0.82	1.78	1.23
8.	Urvasi junction	6.55	020	0.53	1.89	1.04
9.	China waltair	6.53	212	0.48	2.00	1.20
10.	Old CBI Junction	6.77	223	0.47	2.10	1.34
11.	Sheelanagar	6.85	567	0.81	2.99	1.69
12.	Kapulluppada	6.75	450	1.55	2.80	2.90
13.	Railway station	6.80	225	0.70	2.80	1.32
14.	Dabagardens	6.78	162	0.73	2.70	1.23
15.	Marripalem-2	6.45	055	0.69	2.90	1.43
16.	NAD	6.54	088	0.90	2.98	1.53
17	Gopalapatnam	6.60	347	0.88	2.88	1.33
18	Marripalem	6.77	241	0.79	2.78	1.45
19	104 Area	6.45	059	0.81	3.00	1.43
20.	Gnanapuram		167	0.79	2.80	1.34
21.	Scindia	6.75	027	0.98	3.46	1.22
22.	Airport	7.01	158	1.04	3.40	1.20
23.	Autonagar	6.75	166	1.34	3.49	1.40
24.	MVP	7.70	201	0.89	2.30	1.88
25.	Gajuwaka M.R. Office	7.76	260	1.12	3.10	1.76



Figure: Agriculture, settlement, industry (mining/quarrying) waste discharge (source: Google-Earth)

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